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Hydrologic Engineering Center

Hydrologic Modeling System HEC-HMS

Release Notes

Version 4.2.1
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Hydrologic Modeling System HEC-HMS, Release Notes

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Introduction

Version 4.2 of the Hydrologic Modeling System (HEC-HMS) was completed in August 2016 and released for general use shortly thereafter. Since that time, users have reported difficulty with several features. The development team has also continued careful and systematic testing of the program since the last release. The results of that testing in combination with reports from users have allowed the identification and repair of various problems. Some of these affected simulation results and are described in detail later in this document. The result is this Version 4.2.1 release. It does not include any new features but does provide corrections for the problems reported by users and found by the development team. It is currently available for the Microsoft Windows® operating system and the Linux® operating system.

The program has been designed to be easy to use. However, an understanding of how the program works is critical to producing accurate results. It is suggested that a new user read the *HEC-HMS Quick Start Guide* (Version 4.2 August 2016). The guide briefly describes the basic features of the program in enough detail to begin using it. The guide also includes a step-by-step tutorial.

Installation

The installation package and all documentation are available on the HEC website at <http://www.hec.usace.army.mil/>. This new release is installed independently of any previous versions of the program so you will need to uninstall the previous versions if you do not wish to use them anymore. However, you may keep different versions of the program installed for parallel use or testing if you choose. This new version will automatically open projects developed with any previous version of the program. However, once a project has been opened in Version 4.2.1, it will not be possible to open it with older versions of the program.

Windows

The new installation package is designed to be easy to use. It will take you through the steps of selecting a directory for the program files and making other settings. Use the following steps to install the program on the Microsoft Windows® operating system:

1. Download the installation package from the HEC website to a temporary folder on the computer.

2. Run the installation program. In Windows Explorer, double-click the icon for the installation program. You must have administrator privileges to run the installer.
3. Follow the on-screen prompts to install the program.

Linux

The installation package is delivered as a compressed TAR file. It has several dependencies that must be installed before extracting the installation package. The following commands can be used to configure the dependencies prior to extraction of the installation package.

Red Hat Enterprise Linux 7

```
yum install libldb.i686 libXext.i686  
libXrender.i686 libXtst.i686 libgcc.i686  
libstdc++.i686
```

Ubuntu 14.04

```
sudo apt-get install libc6-i386 libstdc++6:i386  
libxtst6:i386 libxrender1:i386 libgcc1:i386  
libxi6:i386
```

Changes in Operation

Occasionally it becomes necessary to change how an existing feature operates. Only one notable change has occurred since the last software release. A complete description of the change is given below. In general, a change in operation results in changes in the computed results when compared to previous program versions.

User-Specified Unit Hydrograph

The subbasin element includes the user-specified unit hydrograph as one option for transforming excess precipitation to surface runoff. The user must enter the unit hydrograph in the paired data manager and select it in the subbasin element. It has always been assumed that the unit hydrograph entered in the paired data manager used a data entry time interval equal to the duration of the unit hydrograph. The duration has a special meaning because it is the length of time with uniform precipitation rate, yielding unit precipitation volume, which created the unit hydrograph. Calculations in the subbasin element relied on this assumption to

change the duration of the unit hydrograph to match the time interval of the simulation.

The user-specified unit hydrograph method has been completely revised to provide more flexibility as well as to provide better results when there is a big difference between the unit hydrograph duration and the simulation time interval. First, the unit hydrograph entered in the paired data manager now has a separate specification for the duration and the data entry interval. This allows for the unit hydrograph to be specified at a data entry interval independent of the duration of the precipitation that created the unit hydrograph. Second, the s-graph technique used to change the duration of the unit hydrograph to the simulation time interval can lead to fluctuations that are an artifact of the technique itself. The fluctuations become greater as the difference between the duration and time interval increases. A smoothing option has been added that can remove these fluctuations.

The changes to the user-specified unit hydrograph make it much more flexible when specifying the duration of the input data and choosing the simulation time interval. Computed results are now much more accurate, especially in the case of taking a unit hydrograph from a long duration and using it at a much shorter time interval.

Problems Repaired

Several errors were found in the program and repaired. Complete descriptions of each error are given below.

Muskingum Cunge Channel Routing

The Muskingum Cunge routing method offers several shapes including the eight point cross section. It was found that in certain cases where the overbank side slope was almost flat that calculations could produce a negative celerity. This was an error because negative celerity has no physical interpretation in a hydrologic routing method. A new adaption has been added that eliminates the possibility of calculating a negative celerity.

Manual Entry Gage Data Not Copied

A time-series gage can be copied from the gage manager or directly from the Watershed Explorer. Creating a copy should make a duplicate gage that is identical in every way except for a new name. It was found that manual entry gages did not correctly duplicate the data values. Manual entry data values are now correctly copied.

Total Storm Gages Deleted During Import

A meteorologic model can be imported from another project. Part of importing the meteorologic model is to also import all of the gage data that it uses. Most meteorologic data was correctly imported but irregularities were found with the gage weights precipitation method. Recording gages and other data used in the gage weights method were imported correctly. However, it was found that total storm gages used in the method were not correctly imported. Total storm gages are now correctly imported along with the recording gages and other data.

Optimization Trial Objective Function

The optimization trial provides a selection of different objective functions. It was found that choosing the variance absolute residual function was not saved when closing and restarting the program. All other functions were saved correctly. The variance absolute residual objective function is now saved correctly along with all of the other functions.

Precipitation Gage Missing Data Errors

The previous Version 4.2 release added new error checking to precipitation gage data. The check was intended to screen for negative values which have no physical interpretation. It was found that the new check was not implemented correctly and mistakenly treated zero values as if they were missing. Setting the meteorologic model to replace missing data with default values would resolve the issue. The check for negative precipitation values has been corrected.

Forecast Initial Baseflow

The previous Version 4.2 release added a new feature to forecast alternatives to automatically calculate the initial baseflow using observed flow. It was found that the calculated initial baseflow did not update correctly if the start time changed after selecting the observed flow gage. It was also found that the calculated initial baseflow did not update correctly if no observed flow gage was selected, but the element data changed. The feature has been improved so that changes to the start time, gage selection, and element data are all correctly integrated into calculating the initial baseflow.

Reservoir Auxiliary Flow

The reservoir element provides three different methods for routing flow through the storage pool. The outlet structures routing method provides the option of sending the discharge from one or more structures through an auxiliary flow link. It was found that if the flow link connected to a junction then the simulation would fail. It was possible to connect the auxiliary flow link to any other type of element or to no element at all. The auxiliary flow link has now been repaired so that it can also be connected to a junction.

Copying a Depth-Area Analysis

A depth-area analysis can be copied from the analysis manager or directly from the Watershed Explorer. It was found that a depth-area analysis could not be successfully copied and the program would generate a severe error. The problem has been resolved and it is now possible to copy a depth-area analysis.

Simulation Run Freezes

It was found that computing a simulation run could cause the program to freeze given a certain combination of conditions. If the project contained two simulation runs using the same basin model and same meteorologic model but different control specifications, then computing one of the simulation runs could cause the program to freeze. The source of the problem was identified and has been repaired.

Error with Slider Parameter Editor

The forecast alternative includes the option to configure a custom editor that uses sliders. A slider may control an individual element override or a zone adjustment. It was found that mixing both element override and zone adjustments in the custom editor would cause a critical error. The error has been resolved so that both element overrides and zone adjustments can both be used together.

Documentation

The *Hydrologic Modeling System HEC-HMS: Quick Start Guide* (Version 4.2 August 2016) provides a brief description of the program for new users. It describes the different parts of the interface and the basic steps necessary to obtain simulation results. A tutorial takes the user through the creation of a new project and shows how to obtain results. The guide has been updated to reflect changes in the interface.

The *Hydrologic Modeling System HEC-HMS: User's Manual* (Version 4.2 August 2016) contains extensive information on installing and using the program. Details on the use of each of the features and capabilities in the program are included. The manual has been updated with information describing new features added to the program for this Version 4.2 release.

The *Hydrologic Modeling System HEC-HMS: Validation Guide* (Version 4.2 August 2016) contains information on the procedures used to certify the software for release. The manual describes the tests that have been established and the procedures used for determining the correct result for each test. An accompanying data kit includes all of the project data necessary to replicate the tests performed at HEC prior to certifying a new release for distribution.

The *Hydrologic Modeling System HEC-HMS: Applications Guide* (March 2015) illustrates how to apply the program in a variety of different studies. Data requirements, calibration procedures, and typical results presentation styles are provided for studies ranging from flood risk management to sediment yield.

The *Hydrologic Modeling System HEC-HMS: Technical Reference Manual* (March 2000) continues to accurately describe the mathematical models included in the program. New simulation capabilities have been added to the program and are not included in the manual. The manual is currently undergoing a major revision to expand documentation of existing mathematical models and fully describe the newly added models.

Support Policy

Technical support for program users within the U.S. Army Corps of Engineers is provided through an annual subscription service. Subscribing offices can expect full support from HEC staff in the routine application of the program. Users are strongly urged to consult with HEC staff on the technical feasibility of using the program before beginning a project with unique requirements such as grid cell hydrology, snow melt, continuous simulation, sediment transport, or water quality. Special guidance is also available for the development of models for flow forecasting. Extended support for large or complex projects can be arranged under a separate reimbursable project agreement.

Support cannot be provided to users outside the U.S. Army Corps of Engineers. Several companies and organizations offer varying levels of support, some through a fee-for-service support similar to the support provided to subscribing Corps offices. Such service

agreements are between the user and the vendor and do not include HEC staff. Vendors can be located through internet searches.

Reporting of suspected program errors is unrestricted and we will reply to all correspondence concerning such errors. We are continuously working to improve the program and possible bugs should always be reported. Reports should include a written description of the steps that lead to the problem and the effects that result from it. If we cannot reproduce the reported problem, we may ask you to send a copy of your project.

Request support or report program errors through the following channels:

- Visit our web site at <http://www.hec.usace.army.mil>.
- Send email to *hec.hms@usace.army.mil* on the internet.
- Fax 530.756.8250 any time.
- Call +1.530.756.1104, 7:30 am to 4:30 pm Pacific Time Monday through Friday.

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